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British Journal of Oral and Maxillofacial Surgery 53 (2015) 326–331

BRITISH Journal of Oral and Maxillofacial Surgery

www.bjoms.com

Efficacy of the technique of piezoelectric corticotomy for orthodontic traction of impacted mandibular third molars☆

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Accepted 2 January 2015
Available online 28 January 2015

Abstract

Our aim was to assess the efficacy of piezoelectric corticotomy for orthodontic traction of mandibular third molars close to the inferior alveolar nerve. Thirty patients with impacted third molars close to the nerve were included in the study, 15 of whom were treated with conventional orthodontic traction and 15 with piezoelectric corticotomy. We recorded duration of treatment including exposure and orthodontic traction, and time to the final extraction. Postoperative complications including trismus, swelling, and pain were also noted. Alveolar bone levels mesial and distal to the second molars were evaluated on cone-beam computed tomographic (CT) images. Student's *t* test was used to assess the significance of differences between the groups. After orthodontic treatments all impacted third molars were successfully removed from the inferior alveolar nerve without neurological damage. The mean (SD) duration of surgical exposure in the piezoelectric corticotomy group was significantly longer than that in the conventional group ($p = 0.01$). The mean (SD) duration of traction was 4 (2.3) months after piezoelectric corticotomy, much shorter than the 7.5 (1.3) months in the conventional group ($p = 0.03$). There were no significant differences in postoperative complications between the groups. There was a significant increase in the distal alveolar height of second molars after treatment in both groups ($p < 0.01$). We conclude that the use of piezoelectric corticotomy allows more efficient and faster traction of third molars with a close relation between the root and the inferior alveolar nerve, although it took longer than the traditional technique.

Keywords: Piezoelectric corticotomy; Orthodontic traction; Cone-beam CT; Impacted third molar; Bone formation

Introduction

Neurological changes that result from damage to the inferior alveolar nerve are the most serious complication of the extraction of mandibular third molars, and the incidence of associated paraesthesia has been reported to be 1.1%.[1] The main factor is the proximity of the roots of the tooth to the nerve.[2] The application of orthodontic traction can successfully displace the roots away from the nerve, which reduces the risk of damage.[3–5] However, the duration of treatment is often long, the mean (SD) in our previous report being 6.6 (SD = 2.1).[6] Mesially inclined and horizontal teeth often require longer treatment (6–12 months).[4]

☆ This project was supported by Shanghai Municipal Education Commission Research Fund for Young College and University Teachers (jdy11027), Research Fund of Shanghai Municipal Health Bureau (20134Y061) and College Scientific Research Fund (2012-12).

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http://dx.doi.org/10.1016/j.bjoms.2015.01.002

Corticotomy of the alveolar bone, which has recently been introduced into orthodontics, enables the orthodontist to facilitate the movement of teeth.[7] With the technique one tooth can be moved 2–3 times further in a third or a quarter of the time required for traditional orthodontics.[8] This is a remarkable advance in the case of regional orthodontic treatment using simple orthodontic devices. Piezoelectric surgery® is efficient for osteotomy because it is a selective, micrometrical cut that produces a limited area of bleeding.[9] We have used piezoelectric corticotomy of the alveolar bone to facilitate orthodontic movement of teeth and compared it with conventional orthodontic traction for impacted third molars. The aim of the study was to find out which of these two techniques was better for orthodontic traction of mandibular third molars close to the inferior alveolar nerve.

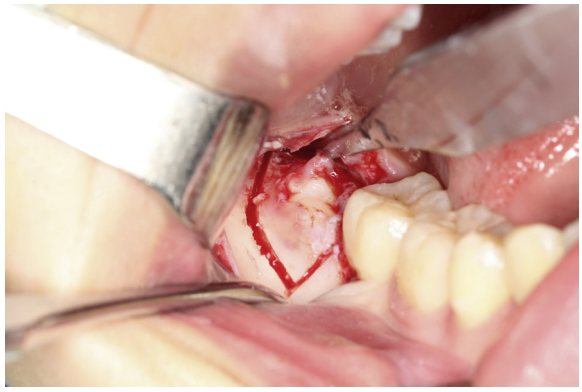

Fig. 1. Two vertical cuts were made mesially and distally around the third molar. The horizontal osteotomy connected with vertical osteotomies was also made by piezosurgery®.

Patients and methods

Between August 2010 and August 2013, 30 patients were recruited from the Department of Oral Surgery, Shanghai Ninth People's Hospital affiliated with Shanghai Jiao Tong University, School of Medicine (Shanghai, China). The protocol was approved by the local ethics committee (201048) and patients gave informed consent. All the operations were completed by the same surgeon, and orthodontic treatments by the same orthodontist.

The selection criteria included patients who were judged to be at high risk of injury to the inferior alveolar nerve based on radiographic features in routine preoperative dental pantomographs and cone-beam computed tomography (CT, J. Morita Mfg Corp, Kyoto, Japan), and whose mandibular third molars were impacted and in need of exposure (we included third molars with horizontal, mesioangular, and vertical impaction according to the classification of Tay et al.[10]). Participants had no periradicular conditions or active periodontal disease, no tooth loss, no systemic diseases, and they did not smoke.

The treatment methods were randomly assigned using a computer-generated randomisation list. Fifteen patients (6 men and 9 women, mean (SD) age 27 (5.6) years) were treated by traditional orthodontic traction, and the other 15 patients (5 men and 10 women, mean (SD) age 24 (4.8) years) were operated on with surgically assisted orthodontic traction with piezocorticotomy.

Surgical and orthodontic technique

After block anesthesia with local infiltration of the buccal nerve had been given, a full-thickness intrasulcular flap was fashioned from the mesial to the distal margins of the second molar with a distal releasing incision. The mucoperiosteal flap was reflected to expose the third molar and the cortical bone. In the conventional traction group the bone on the occlusal and buccal surfaces of the tooth was removed by low-speed drilling with copious irrigation for cooling. In the piezocorticotomy group the bone was removed with a piezoelectric device (Piezosurgery®, Silfragent, Italy). The amplitude of the microvibrations was from 80 to 100 μm with a frequency of 28 to 32 kHz, corresponding to a handpiece power rating of 45 W. Vertical corticotomy cuts were made around the root of the third molar, and stopped just short of the alveolar crest (about 2 mm). These cuts were connected near the apices of the teeth with a horizontal cut. Cuts were made just beneath the buccal cortical plate (Fig. 1).

The orthodontic appliance was inserted and bonded to the buccal surface of the impacted tooth. As described in our previous paper, two steps were used for mesially and horizontally inclined third molars and one step for vertically impacted teeth.[6] A hook was bonded with a light-cured composite on the exposed surface of the impacted tooth, and a 3-loop spring (0.016 in. stainless steel) was welded to the adjacent second molar band with the end in contact the hook, to distalize the mesially or horizontally impacted molar first. A cantilever 0.017 in. × 0.025 in. was then used to push the third molar upright and extrude it (Fig. 2).

The patients were monitored every month for the movement of the impacted teeth. Cone-beam CT was used to evaluate the relation between the roots and the inferior alveolar nerve before extraction. Once the impacted root apex had been separated from the nerve the third molar could be removed. An antibiotic (amoxicillin; 50 mg/kg in 2 daily doses for 3 days) and an analgesic (paracetamol; 750 mg every 6 h) were prescribed as necessary. Rinsing with 0.12% chlorhexidine gluconate was also recommended. The wound was sutured, and the sutures removed one week later.

Clinical assessments

The duration of treatment was the primary outcome variable, including the exposure, orthodontic traction, and final dental extraction after the root had separated from the nerve. Duration of anaesthesia, flaps, and sutures were not recorded.

All subjects had a follow-up visit after 48 h for evaluation of trismus, swelling, and pain. Trismus was evaluated by a measurement of the difference of maximal interincisal